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ABSTRACT

During the academic year 1983-84, Drexel University instituted a new policy requiring all incoming students to have access to a microcomputer. The computer chosen to fulfill this requirement was the Macintosh from Apple Computer, Inc. Because Drexel University received one of the first large shipments of this new product, the degree to which these machines would be perfectly operational upon arrival was unknown. Everyone associated with the Microcomputing Program at Drexel University felt it essential that students not receive faulty machines. To this end, a process was set up whereby each Macintosh received would be checked out for basic functionality and to insure that all required parts were included. This paper describes the machine check-out process during both the first and second distribution periods. Attachments include the initial proposal for the machine checkout process and the checkout workstation map with tasks and work flow indicated. (THC)

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Machine Check-Out

Drexel University

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Machine Check-Out

During the academic year 1983-84 Drexel University instituted a new policy requiring that all incoming students have personal access to a microcomputer. The computer selected[1] to fulfill this requirement was the 128K Macintosh, which became commercially available in January, 1984.

Because Drexel University received one of the first large shipments of this new product, the degree to which these machines would be perfectly operational upon arrival was a complete unknown. Apple had built an elaborate quality control system into their state-of-the-art Macintosh production facility, with checking at every point in the manufacturing process and a 'burn-in' period. But the effectiveness of these controls and the degree to which adjustments would be needed after cross-country shipping had not been tested.

Everyone associated with the Microcomputing Program at Drexel University felt it essential that students not receive faulty machines. The program was new. It was important that it start out well. A lot of non-functional machines could do much harm to the program's image. In addition, half of all Drexel students live at home. It would not be easy for them to bring back machines for repairs. And finally, staff needed to know for sure that machines brought back for repairs or missing parts had been indeed functional and complete when picked up by their new owners. To this end, a process was set up whereby each Macintosh received would be checked out for basic funtionality and to insure that all required parts were included.

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[1] For a discussion of the process whereby the specific brand of computer to be used in this program was selected, see "Choosing the Machine," available from the Microcomputing Program, Drexel University, Philadelphia, PA 19104. No charge.

Apple Computer Company also was concerned that machines were fully operational when delivered to students. Because of the high visibility of both the Drexel program and their new machine, a lot of press and other attention was focused on this first massive distribution of Macintosh computers. To guarantee that all went well, Apple sent four of their technical staff to Drexel to observe and participate in the initial check-out process. The following is a discussion of the way in which this process took place and evolved during two distribution periods.

The check-out process. The process itself includes the unboxing of each unit; a complete inventory of package components[2]; booting up the unit to observe screen display; attachment and testing of both mouse and keyboard; validation, recording, and re-verification of all serial numbers; and reboxing of the unit and all components. (See Attachment, The Check-Out Process, for a complete description of this process, including a diagram of the work stations set up for this purpose. See Technical Working Paper T 84-3, "Logo Burn-In," for a discussion of the 'hot stamp' process.)

Actual experience: First distribution period. Check-out of machines received late February, 1984, revealed excellent quality control during the manufacturing of the machines and almost no adjustments required after cross-country shipping. The primary problem turned out to be incomplete packaging, with a missing keyboard being the most common offense.

Of the 2100 machines received during the first shipment, none was unusable. Fifty required some kind of adjustment. But due to the presence of the four Apple technicians, the minor nature of most adjustments needed, efficient planning of the check-out procedure, and the fact that a

[2]In addition to the computer, the Macintosh package delivered to Drexel includes four boxes, one containing a power cord, Macintosh manual, a system diskette plus a blank disk for backup, a programming switch, and a 'guided tour' of the Macintosh (audio cassette plus diskette); one containing the 'mouse'; one containing the keyboard; and one containing two MacWrite/MacPaint diskettes, a 'guided tour' of the MacWrite/MacPaint (audio cassette plus diskette), and a manual for each of the two programs.

good supply of spare parts was available, the entire check-out of these 2,100 machines was accomplished and all machines made operable within 2 1/2 days, half the time estimated during initial planning.

Fifty to sixty people participated in this process. A complete description of the check-out process is outlined in the attachment at the end of this paper. This outline accurately describes the process used with two exceptions: (1) the hot stamp was not applied during the first check-out period[3] and (2) some modifications were made during the second and third days based on experiences during the first day of check-out. (These modifications are discussed below in the report on the first check-out period.)

The actual staffing was as follows: Twenty individuals were used for inventory control. (They were employees of the Comptroller's Office and the University Store.) Seven, for testing equipment and making minor repairs, were from the staff of the Microcomputing Program's Equipment and Repair Group. The rest of the participants, also used for testing, came from the staff of the Microcomputing Program's User Support Group (consultants on microcomputer use) and Instructional Support Group (software designers and programmers)[4].

According to the report on this check-out:

> Check-out went smoother than expected. Original calculations showed 180 units per hour could be done at 100% efficiency. Realistic [hunches] reduced that number to 100 per hour. In actuality, we were able to achieve a check-out rate of 275 machines per hour. Several major factors contributed to the increased rate.

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[3]For the first shipment, Apple Computer Company stamped on the Drexel logo at their production facility prior to shipping. This service was later discontinued.

[4]See Administrative Working Papers A 84-9, "Hotline and Walk-In Consulting," and A 84-14, "Instructional Support Group," for more information on these two groups.

Extra personnel [3] were on hand and available to perform various miscellaneous duties:

- taking all plastic wrap off the pallets
- cutting open the individual cartons
- taking away empty pallets
- removing trash from working areas

An extra person was dedicated only to pallet movement.

The first day was a 'trial run'; we checked the mice, keyboards and CPUs of 275 Macs and wrinkled out unexpected problems (e.g., serial number/model number configuration, transposed model number within the serial number). Based on findings in the trial run, we decided NOT to test the mice or keyboards that were in the remaining cartons. This yielded a considerable time savings because those modules were packaged completely in plastic and their removal would have also increased the trash.

We took a 'scheduled' 15-minute coffee break in the morning and a one-hour lunch break.

The 'Loader' [Comptroller's staff] also placed the MacWrite/ MacPaint software in the Mac carton. The 'Carriers' re-taped the cartons, placed them on a dolly and took the units to the completed area.

In order to facilitate the supply to the check-out stations, Macs were only stacked one pallet high when they were taken off the trucks. We used our pallet jack to move pallets internally.

We tried to start each day with each station ready for operation. [Supervisors] came in early to set up supplies and a beginning stock.

The most common technical problem found within this first shipment was the need to adjust the horizontal hold on the CRT. Approximately 30 machines required this minor adjustment.

Actual experience: Second distribution period. The second major shipment of Macintosh computers arrived at the University in September, 1984. At that time, 1,800 machines were received. Based on experiences during check-out of the first major shipment, the following modifications were made:

The check-out staff was reduced from 50-60 operating six workstations during the first check-out to 30 persons operating three stations. The complete check-out was still completed in 2 1/2 days, despite this staff reduction and the fact that the 'hot stamp'[5] procedure was added.

Quality control was as good, perhaps even better, on machines shipped for the second distribution. There was no dominant technical problem.

[5]As noted above, this procedure is described in Technical Working Paper T 84-3, "Logo Burn-In."

Attachments

Initial Proposal for Machine Checkout Process

Checkout Workstation Map with Tasks and Work Flow

INITIAL PROPOSAL FOR MACHINE CHECKOUT PROCESS

Draft Date Jan. 23, 1984

This proposal is an attempt to define the requirements of space, staff and time necessary to check out and prepare the DU microcomputers for distribution. It is still a preliminary document and should not be perceived as finalized policy.

Assumptions:

- Units will be turned on, booted but *not* "burned-in" or operated. All serial numbers will be validated, recorded and re-verified.

- Checkout process will take place approx. one week prior to distribution. However, it is remotely possible that distribution will take place at the same time some check-out is taking place. If both processes take place concurrently, the need for storage space in the warehouse decreases, but that space will be used by the distribution area and most of the warehouse space will have to be utilized. In the event of concurrent processes, manpower and staffing requirements will be significantly affected.

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Physical Requirements:

* a clean warehouse
* temperature set at or near 60° F (space heaters ???)
* electrical facilities for 20 outlets per workstation (10 per table)
* good indirect lighting (current lighting appears adequate if all fixtures are operable).
* security bars on windows
* secure doors
* 12 tables for workstations sized at approx. 5' x 2 1/2'
* 1 electric fork lift for 2 to 3 weeks -- max. height will be 15'
* 6 trucks or carts to transport units (these are included in "Repair Facilities Requirement" memo dated Oct. 17, 1983)
* 3 electric cords/outlets hanging from ceiling for hot stampers
* 6 large trash cans (plastic barrels on wheels) with a large trash dumpster outside
* 12 to 15 chairs for breaks

"SLOW" TIME AND STAFFING REQUIREMENTS FOR CHECK OUT:

2	min.	Unloader	Open, unpack record ser. nos. (3 sets), place on table
2	min.	Technician Checkout	Hook-up and check out
4	min.	Loader	Verifies serial nos., repacks units, re-seals boxes
2	min.	Carrier	Moves units to "completed" stack
10	min.		

1 machine/10 min. x 60 min/hr x 10 hr/day/workstation = 60 machines/w.s./day

6 workstations x 60 machines/w.s./day = 360 machines/day

5 days x 360 units = 1800 machines in a regular work week

Extras (if any) must be processed during evenings, weekends, extra days.

Staff Requirements: (Minimum required for "slow" check out procedure)

1 Forklift driver (J. Mueller staff)

3 Carriers

3 Unloaders

3 Technicians

6 Loaders (J. Ragg staff)

1 General supervisor

1 Technical supervisor

18 TOTAL

NOTE: ESG staff of 5 may be used as part of the total of 18; J. Ragg will supply 6 people; J. Mueller will supply one forklift driver,. Therefore 6 additional personnel will be required.

ALSO: 2 security guards x 3 shifts = 6 guards for 24 hrs/day for 2 or 3 weeks.

NOTE: It is assumed additional staff will be available to sort software and other items to be distributed into an additional bag or package.

TIME AND STAFFING REQUIREMENTS FOR "OPTIMAL" CHECK OUT PROCESS:

2	min.	Unloader	Open, unpack record ser. nos. (3 sets), place on table
2	min.	Technician Checkout	Hook-up and check out
4	min.	Loader	Verifies serial nos., repacks units, re-seals boxes
2	min.	Carrier	Moves units to "completed" stack
10	min.		

Calculations can be based "per technician" as he is the focal point of the production process. Each technician is theoretically capable of checking 30 machines in one hour. Each technician would then require two loaders to handle his output. If we assume an average of 5 (five) technicians , allowing for breaks, lunches, etc., and we assume an average of twenty (20) machines checked per hour, then the completion would be as follows:

5 technicians X 20 machines/hour= 100 machines/hour

100 machines/hour X 10 hours/day= 1000 machines/day

Therefore, the entire process can be completed in 2.5 days

Staff Requirements:(Minimum required for "optional" check out procedure)

1 Forklift driver (J. Mueller staff)

6 Carriers

6 Unloaders

6 Technicians

12 Loaders (J. Ragg staff)

1 General supervisor

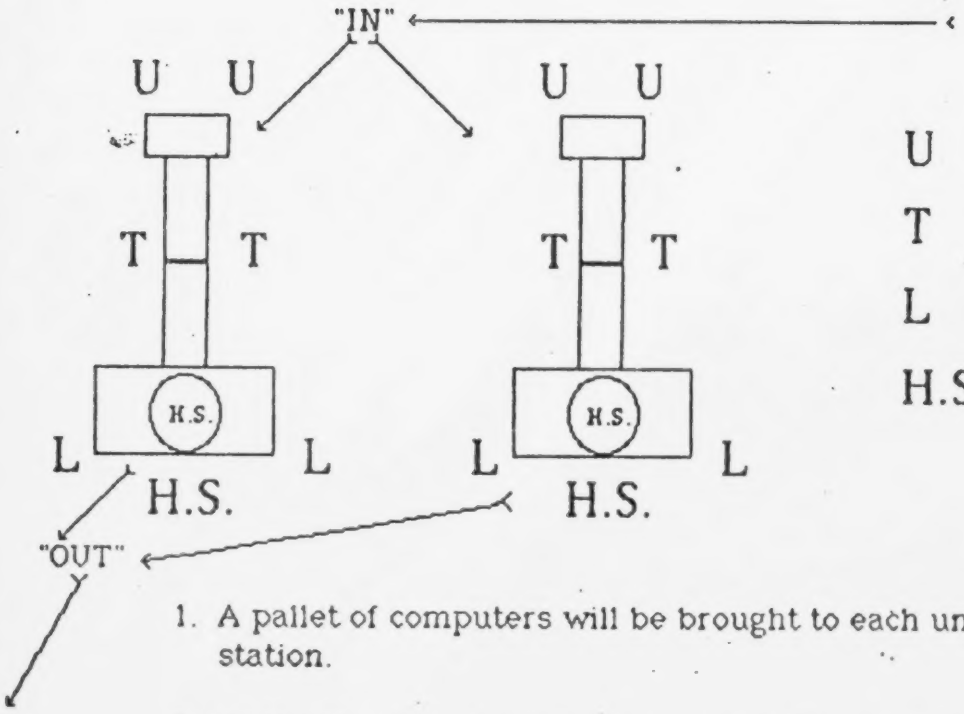
1 Technical supervisor

33 TOTAL

NOTE: The ESG staff of 5 is available for use; J. Ragg will staff the 12 "Loaders"; J. Mueller will supply the forklift driver. Therefore, 15 additional people will be neded.

ALSO: 2 security guards x 3 shifts = 6 guards for 24 hrs/day for 2 or 3 weeks.

NOTE: It is assumed additional staff will be available to sort software and other items to be distributed into an additional bag or package.



U = "Unloader"

T = "Technician"

L = "Loader"

H.S.= "Hot Stamper"

1. A pallet of computers will be brought to each unloader's station.

2. At the Unloader area, the computers will be unpacked; components will be verified and serial numbers will be recorded on a label outside the carton. The computer will be placed on the table for the Technician to check out. It is imperative that the original carton (now serialized) remains in the production process with the computer.

3. The Technician area is where the computer is checked for functionality. One Technician station will check the mouse and keyboard, the others will not. The Technicians will be advised at check-out time as to the extent of their testing.

4. The Hot Stamper will then apply the Drexel Logo ("D").

5. The Loader area is where the computer is re-packaged, recorded serial numbers are verified and this is last check to make sure all components are there and re-assembled properly. The Loader should also help control the flow around the Hot Stamper and make certain the cartons are moved along the line with its correct computer.

6. The completed computers will then be placed on a hand truck, and then removed to the stacking part of the warehouse for storage.